# Sovereign Default, International Lending and Trade

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**Abstract**

This paper sheds new light on the "trade costs" of sovereign default. It argues that the decline in trade in the wake of sovereign debt crises documented in earlier studies is the result of a reduction in exporters' access to foreign credit. Using an annual panel of 28 industries in 100 countries between 1980 and 2007, it shows that default leads to a stronger contraction in the exports of sectors which are more dependent on external financing, consistent with this hypothesis. This finding is robust across different econometric specifications, and of economically significant magnitude. It suggests that any impact of sovereign default on trade, rather than a cost of default in its own right, may be a symptom of reduced access to international capital markets.

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# 1 Introduction

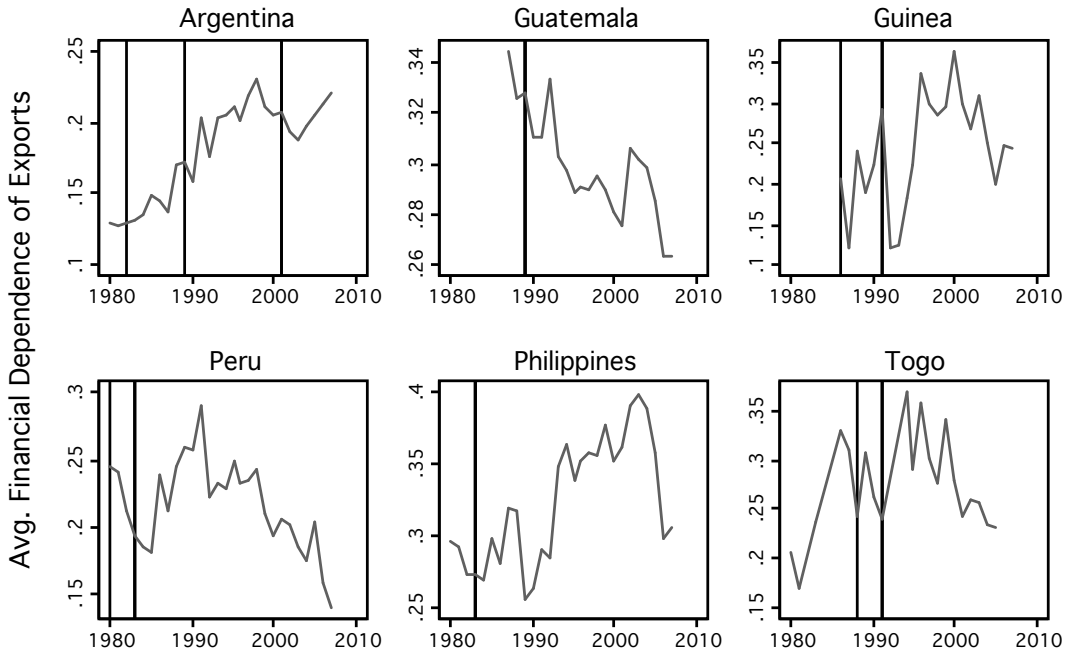
This paper sheds new light on the nature of the supposed "trade costs" of sovereign default. I employ a large panel of developed and developing countries to analyse the impact of default episodes on countries' sectoral export behaviour. The key finding is that default leads to a stronger reduction in the exports of sectors which are more dependent on external financing. I argue that this empirical pattern is consistent with a decline in credit supply to domestic exporters. My estimates suggest that most of the adverse impact of sovereign default on trade found in earlier studies is explained by this credit channel. They contradict the widespread notion that reduced access to international goods markets constitutes a cost of sovereign default. Instead, shifting trading patterns may be a symptom of reduced access to international capital markets.

Figure 1 plots the time-series pattern of a measure of the financial dependence of exports for six countries which experienced at least one sovereign default episode between 1980 and 2007.[1] Vertical lines indicate the timing of these episodes. Sovereign defaults tend to coincide with, or to be followed by, declines in the average financial dependence of exports, indicating a shift in the composition of exports away from highly financially dependent and towards less financially vulnerable goods. The main contribution of this paper to establish the generality of this observation econometrically, and to highlight that it may be understood as a result of a temporary comparative disadvantage inflicted upon exporters by a reduction in capital-market access.

The view that the economic costs of sovereign default manifest themselves partly in the pattern of trade flows has a long tradition in the literature on sovereign borrowing. For example, in their seminal paper about sovereign lending in the presence of strategic default Eaton and Gersovitz (1981) justify the assumption that defaulters incur a direct output cost by appealing to "retaliatory interference by the creditors or their governments with commodity trade". Similarly, Bulow and Rogoff (1989) argue that foreign lenders' ability to interfere with debtor's trade flows poses a credible threat, claiming that fear of "trade sanctions can plausibly explain the actual repayments that do occur".

These examples reflect a wider, as yet unanswered, question about the incentives for sovereign debtors to honour their obligations towards foreign

[1] Following Do and Levchenko (2007), I calculate country $c$'s average financial dependence of exports in year $t$ as $\sum_i FinDep_i Exp_{cit} / \sum_i Exp_{cit}$ where $Exp_{cit}$ are sector-$i$ exports by country $c$ in year $t$, and $FinDep_i$ is a measure of the financial dependence of production in sector $i$. Data sources and definitions are discussed in greater detail in Section 5.




Notes:
Export data is taken from the World Bank WITS coded at the 3-digit level of ISIC. Financial dependence is defined as in Rajan and Zingales (1998). Vertical lines indicate sovereign debt crises. Data sources and construction are discussed in greater detail in Section 3.

Figure 1: Default and the Average Financial Dependence of Exports, Selected Countries

creditors. By definition, loan contracts with sovereign entities suffer from limited legal enforceability. Yet for decades large volumes of such international loans have been extended, and subsequently repaid. Much research has been dedicated to uncovering the economic penalties for default which may sustain these cross-border financial transactions, and "trade costs" are one among several explanations which have been put forward. The threat of exclusion from international capital markets is a prominent alternative explanation. While there is extensive evidence that countries which default on their international debt obligations experience reduced access to international capital markets,[2] the impact of sovereign default on the debtor economy's trade with the rest of the world has only recently started to receive formal empirical attention.

Rose (2005) is the first to document that debt renegotiations are followed by a significant and sustained decline in trade between the debtor country and its foreign creditor nations. Applying a gravity regression to an unbalanced panel of over 150 countries in the period 1948-1997, he finds a significant 7% annual decline in exports and imports between countries involved in debt renegotiation, lasting for 15 years. Although he remains agnostic about the precise explanation for this observation, Rose interprets his findings as consistent with deliberate trade sanctions by creditor nations designed to punish

[2]See Gelos et al. (2003), Arteta and Hale (2008), Fuentes and Saravia (2010) and Mendoza and Yue (2008) for recent examples.

obstinate debtors. Subsequent work by Martinez and Sandleris (2008) casts doubts on this interpretation: using the same methodology and data, they cannot reject the hypothesis of an equal decline in the debtor country's trade with all its trading partners, whether sovereign creditors or not. They also note the absence of a single known instance in which sovereign default was punished with overt trade sanctions in the last 30 years.[3]

Since Rose (2005) uses aggregate trade data and fails to pinpoint a clear causal link between default and the decline in trade, his findings are open to the criticism of reverse causality and omitted variable bias. For this reason, Borensztein and Panizza (2010) take a different approach to identifying the "trade costs" of default. The authors use a panel of 28 industries in 24 countries for the period 1980-2000 and show that sovereign default causes a larger decline in the value-added growth of export-oriented sectors. Since their study exploits the differential impact of default at the sector level it is less likely to suffer from reverse causality and omitted variable bias, providing further evidence that debt crises "hurt" exporters. However, just as its precursors, it does not explain why this might be the case.

This paper is closely related to Borensztein and Panizza (2010). Like them, I employ a difference-in-difference approach in the spirit of Rajan and Zingales (1998) to study the impact of sovereign default at the sector level.[4] Unlike them, I test directly for a particular causal link between sovereign default and trading patters − namely that default reduces exporters' access to external financing. My identification strategy, which is firmly grounded in modern trade theory, predicts a differential impact of default on the volume of exports. This allows me to ascertain how much of the decline in trade flows attributed to default in earlier studies can be explained as a result of the credit-channel emphasised here. The present empirical analysis also benefits from a significantly larger sample, covering 28 industries and 100 countries between 1980 and 2007.

My regressions show that default episodes result in the strongest decline in the exports of those sectors which are most dependent on external financing. This finding is robust to additional controls for other financial crises and

[3]By contrast, Mitchener and Weidenmier (2005) document that between 1870 and 1914, disgruntled creditors did resort to gunboat diplomacy to punish instances of sovereign default, and that such "supersanctions" triggered a decline in trade.

[4]Following their seminal paper on financial development and growth, the Rajan-Zingales methodology has been adopted by a number of authors for empirical studies in a variety of contexts. Among others, it has been used to examine the effect of financial development on growth and output volatility (Fisman and Love, 2003; Braun, 2003; Raddatz, 2006), the impact of financial liberalisation on exports and growth (Manova, 2008; Levchenko, Rancière and Thoenig, 2009) and the consequence of banking crises for value added and exports (Kroszner, Laeven and Klingebiel, 2006; Iacovone and Zavacka, 2009).

alternative industry characteristics, and independent of the precise sample composition and the lag structure of the econometric model. It lends strong support to the hypothesis that shocks to foreign credit supply can explain the "trade costs" of sovereign default. Based on my estimates, this credit channel accounts for most of the overall impact of sovereign default on trade.

From the vantage point of the empirical literature on financial development and trade, this paper's findings mirror the study by Manova (2008). Her work examines the impact of financial liberalisation on trade, and finds that it boosts the exports of the most financially vulnerable sectors. Treating default as "inverse" financial liberalisation, I find that it leads to the largest contraction in the exports of the sectors which are most dependent on external financing.

The remainder of the paper is structured as follows. Section 2 motivates my identification strategy with a simple model of international lending and trade in a small, open and capital-scarce economy. Section 3 describes the data and presents the empirical results. Section 4 concludes.

# 2 The Model

In the following, I develop a standard model of intra-industry goods trade between countries. I assume that capital is perfectly mobile internationally and introduce the effect of sovereign default as a "black-box" increase in international financial frictions which raises the cost of borrowing in the defaulting economy. The model serves to highlight the key identifying assumptions underlying the regression equations estimated in Section 3.

## 2.1 Assumptions and Derivations

### 2.1.1 Demand

Let the world consist of $C$ countries, $c \in \{1, ..., C\}$, and let there be $I$ industries, $i \in \{1, ...I\}$. Industry $I$ produces a perfectly tradable homogenous good, using labour only, which can be assembled in any country with identical unit labour productivity. However, in all other industries $i \in \{1, ...I-1\}$ countries have access to a specific technology for manufacturing a unique, perfectly tradable variety $c$. As a result $C \times (I-1) + 1$ goods will be produced and traded in equilibrium.

Suppose perfectly competitive producers in each $c$ assemble a non-traded final good in industry $i \in \{1, ...I-1\}$ from the set of tradable, country-specific varieties using a production technology described by the minimum-cost

function

$$B_{it}\left(Q_{cit}\right) = \left(\sum_{c'=1}^{C} p_{c'it}^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}} Q_{cit}, \tag{1}$$

where $p_{c'it}$ denotes the price at time $t$ of the perfectly tradable product variety produced by country $c'$ in industry $i$, $Q_{cit}$ is the desired final-good output of industry $i$ in country $c$ and $\varepsilon > 1$ represents the elasticity of substitution between varieties. Final-good output in each industry, therefore, is a CES aggregate of the $C$ country-specific varieties. It is now straightforward to show that total nominal demand for goods produced by country $c$ in industry $i$ is equal to

$$p_{cit}\hat{q}_{cit} = \left(\frac{p_{cit}}{P_{it}}\right)^{1-\varepsilon} \sum_{c=1}^{C} E_{cit}, \tag{2}$$

where $P_{it} \equiv \left(\sum_{c'} p_{c'it}^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}}$ and $E_{cit}$ is nominal spending by country $c$ in industry $i$ at time $t$. Demand for each variety $c$ in industry $i$ is thus directly proportional to total world spending on industry-$i$ goods, and inversely proportional to its share in a measure of the industry price level, $P_{it}$.

### 2.1.2 Supply

The unique, country-specific technology for producing variety $c$ in industry $i$ is described by the minimum-cost function

$$b_{cit}(q_{cit}) = \frac{1}{A_{ct}} \left(\frac{R_{ct}}{\alpha_i}\right)^{\alpha_i} \left(\frac{W_{ct}}{1-\alpha_i}\right)^{1-\alpha_i} q_{cit}, \tag{3}$$

where $q_{cit}$ is the output of good $c$ in industry $i$, $A_{ct}$ is a measure of country $c$'s total factor productivity, and $R_{ct}$ and $W_{ct}$ are, respectively, the cost of capital and the wage rate in $c$ at time $t$. The parameter $\alpha_i \in (0,1)$ is a measure of industry $i$'s capital intensity.

Capital is perfectly mobile across industries and borders. Meanwhile, labour is perfectly mobile across industries within countries, but not across borders. Normalising the price of the homogenous, perfectly tradable industry-$I$ good to 1 nevertheless ensures that $W_{ct} = 1 \; \forall \; c$.

Let product and factor markets be perfectly competitive. Then,

$$\hat{p}_{cit} = \frac{R_{ct}^{\alpha_i}}{A_{ct}\alpha_i^{\alpha_i}\left(1-\alpha_i\right)^{1-\alpha_i}}, \tag{4}$$

$$\hat{k}_{cit} = \frac{\alpha_i \hat{p}_{cit}\hat{q}_{cit}}{R_{ct}}, \tag{5}$$

where $\hat{k}_{cit}$ denotes the demand for capital at time $t$ by industry $i$ in country $c$.

### 2.1.3 A Small, Capital-Scarce Economy

Suppose the ability of country $c$ to rent capital in international markets is impaired by the presence of a borrowing friction. Specifically, letting $K_{ct}$ equal $c$'s domestic stock of capital,

$$R_{ct} = \begin{cases} R_t & \text{if } \sum_i \hat{k}_{cit}\left(R_{ct}\right) \leq K_{ct} \\ \frac{R_t}{1-\pi_{ct}} & \text{if } \sum_i \hat{k}_{cit}\left(R_{ct}\right) > K_{ct} \end{cases}, \tag{6}$$

where $R_t$ is the international rental rate and $\pi_{ct}$ represents the generic friction. One way to interpret $\pi_{ct}$ is as the (perceived) risk that due payments on capital loans from foreigners at $t$ will be expropriated by $c$'s government and redistributed among the residents of country $c$, or diverted towards other projects. Risk neutral lenders will raise the interest rate on capital loans in anticipation of such expropriation.

If $\sum_i \hat{k}_{cit}\left(R_{ct}\right) \leq K_{ct}$, the borrowing friction does not affect $c$'s producers. I will make the assumption that $c$ is capital-scarce, i.e.

$$\sum_i \hat{k}_{cit}\left(R_{ct}\right) > K_{ct}. \tag{7}$$

Clearly, if $\pi_{ct} = 0$, country $c$ can borrow at the world rental rate while if $\pi_{ct} > 0$, the cost of capital in $c$ is higher than in world markets. My empirical analysis in Section 3 tests the hypothesis that sovereign default raises $\pi_{ct}$ without providing a microfoundation for this assertion. Nevertheless, it would be possible to provide a number of theoretical justifications from the recent literature.[5]

So far, I have not specified how the economy's existing stock of capital, $K_{ct}$, is distributed among its residents. Suppose each industry's share of the economy's capital endowment is uncorrelated with the industry's capital intensity. Then industries with a high capital intensity will tend to be more dependent on external finance than industries with a low capital intensity, and we may take $\alpha_i$ as a measure of the industry's financial dependence.

Define $X_{cit}$ as the value of $c$'s exports in industry $i$ at time $t$ and let $E_{it} \equiv \sum_c E_{cit}$. Using equations (1) to (7),

[5]For example, Sandleris (2008) shows that debt repayment may be used optimally by governments to signal private information about their future stance towards foreign creditors. In his model, default signals a hostile future environment for foreign creditors, and thus reduces foreign investment. Similar informational assumptions can also be used to motivate a rise in $\pi_{ct}$ following sovereign default.

$$X_{cit} = \left[ \frac{(1-\pi_{ct})^{\alpha_i} A_{ct} \alpha_i^{\alpha_i} (1-\alpha_i)^{1-\alpha_i} P_{it}}{R_t^{\alpha_i}} \right]^{\varepsilon-1} (E_{it} - E_{cit}) . \quad (8)$$

I assume that $c$ is small, so that changes in $c$ do not affect $R_t$, $P_{it}$, $E_{it}$ and $E_{it} - E_{cit} \approx E_{it}$.

## 2.2 Empirical Implications

Under the assumption that country $c$ is small, it is possible to re-write equation (8) approximately as follows:

$$\ln X_{cit} \approx -(\varepsilon - 1)\alpha_i \pi_{ct} + \Delta_{it} + \Delta_{ct}, \quad (9)$$

where $\Delta_{it} \equiv (\varepsilon-1)\ln[\alpha_i^{\alpha_i}(1-\alpha_i)^{1-\alpha_i} P_{it} E_{it}^{\frac{1}{\varepsilon-1}} / R_t^{\alpha_i}]$ and $\Delta_{ct} \equiv (\varepsilon-1)\ln A_{ct}$. According to equation (9), we should expect two effects of a rise in $\pi_{ct}$ due to default: first, a decline in country $c$'s total exports and, second, a reduction in the exports of sector $i$ which is larger the more financially dependent $i$ (i.e. the larger $\alpha_i$).[6] In other words, we should observe default as a country-industry-time-specific shock.

The next section outlines the paper's empirical strategy which aims to determine whether the effect of sovereign default on sectoral exports is consistent with a model along the lines of the above.

# 3 Data and Empirical Results

## 3.1 Empirical Methodology and Data

### 3.1.1 Empirical Methodology

The main empirical objective of this paper is to establish whether the impact of sovereign default on sectoral export patterns is consistent with the hypothesis that default reduces exporters' access to credit. As illustrated in the previous section, this would require us to observe that sovereign default reduces sectoral exports in accordance with their financial dependence. In order to establish whether this is the case, I employ a difference-in-difference approach in the

[6] Note that the model generates a one-for-one relationship between an industry's capital intensity and its financial dependence by assumption, but this is not a necessary condition for the Rajan-Zingales methdology to be applicable. Their approach – a variant of which will be employed in Section 3 – only requires that i) interest-rate shocks have a bigger effect on the production cost of more financially dependent sectors and ii) financial dependence is a technological feature of each industry that is fixed in the short run. The model outlined in this section provides one example of a setting in which these conditions are met.

spirit of Rajan and Zingales (1998) extended to an annual panel for the period 1980-2007.

Ideally, one would like to estimate the regression

$$\ln Exp_{cit} = \beta_0 + \sum_{n=0}^{N} \beta_{1n} FinDep_i \times Default_{ct-n} + \sum_{n=0}^{N} \beta_{2n} Default_{ct-n} + \beta_3 FinDep_i + \gamma Z_{cit} + \varepsilon_{cit}, \quad (10)$$

where $\ln Exp_{cit}$ is the log of country $c$'s exports in sector $i$ and year $t$, $FinDep_i$ is a measure of sector $i$'s financial dependence, $Default_{ct-n}$ is a dummy taking value 1 if country $c$ defaulted in $t-n$ and 0 otherwise, and $Z_{cit}$ is a vector of control variables. However, as sovereign debt crises tend to occur in economically tumultuous times any such specification would be open to the criticism of omitted variable bias in the set of key coefficients $\{\beta_{1n}, \beta_{2n}\}_n$. For this reason my baseline regression equation takes the form

$$\ln Exp_{cit} = \beta_0 + \sum_{n=0}^{N} \beta_{1n} FinDep_i \times Default_{ct-n} + \delta_{ct} + \delta_{it} + \gamma Z_{cit} + \varepsilon_{cit}, \quad (11)$$

where $\delta_{ct}$ and $\delta_{it}$ are, respectively, two sets of country-time and industry-time dummies.

The advantage of the specification in equation (11) is that the impact on exports of any time-specific country or industry shocks (such as a decline in domestic GDP, or a fall in world demand for sector-$i$ output) should be controlled for by the large array of fixed effects − insofar as their sectoral impact is not systematically correlated with the industry's financial dependence. As such, it allows for $\{\beta_{1n}\}_n$ to be estimated consistently by exploiting cross-sectional and time-series variation in the occurrence of default among the sample countries, and the cross-industry variation in financial dependence. However, it does not permit me to identify $\{\beta_{2n}\}_n$.

Irrespective of this shortcoming equation (11) can be used to test the hypothesis that sovereign default leads to a temporary rise in exporters' cost of obtaining credit, thereby reducing the exports of highly financially dependent industries relative to those which are less financially vulnerable. If it is correct, we should observe $\beta_{1n} < 0$ for $n = 0, ..., N$. Yet, without knowing $\{\beta_{2n}\}_n$, this finding is in principle consistent with sovereign default reducing or increasing exports overall. For the most part I will focus on the differential impact of default across exporting sectors, but Section 3.3.2 provides two alternative estimates of the overall impact of default on manufacturing exports, discusses their plausibility and compares them to the findings of earlier papers.

A practical difficulty in estimating equation (11) concerns the appropriate number of lags, $N$, to incorporate in the estimation. It seems reasonable to suppose that any default-induced rise in the economy's cost of foreign borrowing may persist for months or years after the event. In the baseline estimation, I arbitrarily restrict my regression equation to two lags of the default dummy to capture such persistence. However, in Section 3.2.2 I analyse the robustness of my results to the incorporation of additional lags of default.

### 3.1.2 Data

Data on the value of countries' sector-level exports between 1980 and 2007 is taken from UN Comtrade, via the World Integrated Trade Solution (WITS). WITS reports trade flows annually in current U.S. dollars and coded at the three-digit level of ISIC. I check the data for errors, inconsistencies and changes in definitions and convert it into constant 2000 U.S. dollars, using the U.S. GDP deflator.

Since import flows tend to be more accurately and consistently reported across countries, I base my export series on mirrored import data reported by each country's trading partners. To ensure sufficiently long time series, and sufficient within-country variation, I drop all country years for which fewer than fifteen sectoral export flows can be obtained, all sectoral export series with fewer than fifteen annual observations, and all countries with fewer than fifteen sectoral export series that satisfy this criterion. To minimise the number of series lost, I use exporter-reported data wherever the mirrored data is insufficiently complete.[7] Finally, in order to address potential concerns about reverse causality, I exclude all exporting sectors whose average exports during the sample period exceeded 1% of domestic GDP. The cleaned export data comprises 28 industries for 100 countries, 38 of which experienced at least one sovereign default during the sample period.

As in Rajan and Zingales (1998), financial dependence of sector-$i$ production is defined as the share of capital expenditure not financed from cash flows by the median US firm in that sector, according to Compustat. The measure is based on U.S. firm-level data for two reasons. Firstly, similarly detailed financial data at the firm level is not available for the majority of countries in the sample used here, most notably the set of developing economies. Secondly, even if such data were available, the observed use of finance would reflect an equilibrium market outcome which, to the extent that financial-market

[7] None of the paper's main results are sensitive to using only mirrored, or only exporter-reported trade flows.

| | Median | |
|---|---|---|
| | Defaulter | Non-Defaulter |
| $DC_{c2007}/GDP_{c2007}$ | 0.29 | 0.84 |
| Avg. Financial Dependence of $Exp_{c2007}$ | 0.22 | 0.28 |
| Avg. $CA_{ct}/GDP_{ct}$ *in 2 Years Prior to Default* | -0.08 | - |

Table 1: Economic Characteristics of Sample Defaulters

frictions are pervasive, may reflect domestic market distortions, rather than the true "technological" financial dependence of a sector. Seeing as U.S. financial markets can be viewed as the most frictionless in the world, U.S. data on the use of external financing is likely to provide the best indicator of the technological external financing requirement of different sectors.[8] Table A2 in the Appendix lists this measure of financial dependence for my 28 ISIC industries. The source is Braun (2003).

The default dummy is based on the initial year of any government default on private bank or bond debt, reconciling information from Standard & Poor's (2003), Moody's (2011) and the financial crisis database of Laeven and Valencia (2008). This yields 61 distinct episodes of sovereign debt repudiation across 38 countries. Table A1 in the Appendix provides a comprehensive list of all sample countries, and their sovereign debt crises as covered by my data.

The main additional control variables are country GDP and private-sector domestic credit. Both are taken from the World Development Indicators in current U.S. dollars, and converted into constant 2000 U.S. dollars.

### 3.1.3 Economic Characteristics of Sample Defaulters

If default by country $c$ in year $t$ leads to a temporary rise in the interest rate charged on foreign loans to $c$, the discussion in Section 2 suggests that we should observe a decline in the relative competitiveness of $c$'s exporters in international goods markets in accordance with their degree of dependence on external financing. A key identifying assumption, set out in equation (7), is that default-prone economies rely on the international capital market to finance some of their inputs and, hence, that the foreign interest rate directly affects exporters' production costs. Table 2 documents that this is an appropriate description of the median defaulter covered in my sample.

The table compares two characteristics of interest, the ratio of private-sector domestic credit to GDP and the average financial dependence of exports,

[8]For a more detailed discussion, see Rajan and Zingales (1998).

for countries which did experience at least one default in my sample with those which did not. It highlights that in 2007 the median defaulter's ratio of domestic private credit to GDP − a widely used measure of financial development − was less than half that of the median non-defaulter. This reflects the fact that foreign-debt defaults have predominantly occurred in countries with less developed domestic financial markets, and may imply significant benefits for their exporters from borrowing internationally. In a similar vein, it is noteworthy that the most countries experienced net capital inflows on a large scale

| Dep. Variable: $\ln Exp_{cit}$ | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $Default_{ct}$ | | | -0.109** | |
| | | | (0.044) | |
| $Default_{ct-1}$ | | | -0.115** | |
| | | | (0.050) | |
| $Default_{ct-2}$ | | | -0.061 | |
| | | | (0.047) | |
| $FinDep_i \times Default_{ct}$ | | | | -0.460*** |
| | | | | (0.136) |
| $FinDep_i \times Default_{ct-1}$ | | | | -0.398** |
| | | | | (0.156) |
| $FinDep_i \times Default_{ct-2}$ | | | | -0.147 |
| | | | | (0.147) |
| $\ln GDP_{ct}$ | 0.513*** | 0.094 | 0.074 | |
| | (0.033) | (0.061) | (0.062) | |
| $\ln DC_{ct}$ | 0.672*** | 0.100*** | 0.097*** | |
| | (0.027) | (0.032) | (0.033) | |
| $FinDep_i * \ln DC_{ct}$ | | | | -0.027*** |
| | | | | (0.010) |
| Country F.E. | No | Yes | No | No |
| Industry F.E. | Yes | No | No | No |
| Year F.E. | Yes | No | Yes | No |
| Country-Year F.E. | No | No | No | Yes |
| Industry-Year F.E. | No | Yes | No | Yes |
| Country-Indust. F.E. | No | No | Yes | No |
| Group-Indust. F.E. | No | No | No | Yes |
| Observations | 51,729 | 51,729 | 51,729 | 51,729 |
| Adj. $R^2$ | 0.78 | 0.84 | 0.93 | 0.86 |

The dependent variable is the log of exports to the world by 3-digit ISIC industries, 1980-2007.
Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2: Baseline Regression Results

prior to debt crises, with the current account deficit in the two years prior to the median default episode amounting to 8% of the country's GDP.

The table also shows that the average financial dependence of exports is somewhat lower in defaulter economies. This is no surprise because, to the extent that sovereign default is correlated with weak financial and legal institutions, domestic producers would be expected to specialise in goods that are less reliant on both.[9]

## 3.2 Empirical Results

### 3.2.1 Baseline Specification

The results of the baseline regression are reported in Table 2. Column 4 lists the results from the full specification as set out in equation (11), while columns 1 to 3 detail the outcome of three regressions with a reduced number of explanatory variables.

Column 1 shows that sectoral exports are strongly positively correlated with GDP and domestic credit, after controlling for cross-industry and -year variation using industry and year fixed effects. However, the importance of both variables is drastically diminished once country- and industry-year fixed effects are introduced (Column 2), with only domestic credit retaining a significant positive coefficient, indicating a 0.1% increase in exports for a 1% increase in domestic credit.

Column 3 introduces the default dummy with two lags, as well as country-industry fixed effects. Introducing country-industry dummies boosts the regression's adjusted $R^2$ to .93 as, predictably, the variation in sectoral exports across countries is substantially larger than the variation of countries' exports within industries over time. The new set of fixed effects alters the coefficient estimates of GDP and domestic credit little. Meanwhile, the coefficient estimates for the default dummies suggest that debt crises are associated with a contemporaneous decline in exports of 11% and a decline of 12% in the subsequent year, both of which are statistically significant at the 5% level. There is little evidence of an impact on exports in the third year, but the hypothesis that the three coefficients are jointly insignificant can be rejected at the 5% level of statistical significance. Overall, this finding is suggestive of a decline in manufacturing exports as a result of default but, owing to the omitted variable problem discussed in Section 3.1.1 as well as the possibility of reverse causality from exports to the likelihood of

[9]See Beck (2003) and Nunn (2007) for two papers which test this hypothesis formally, and find it to be supported by the data.

| Dep. Variable: $\ln Exp_{cit}$ | (1) | (2) | (3) |
|---|---|---|---|
| $FinDep_i \times Default_{ct}$ | -0.464*** | -0.441*** | -0.445*** |
| | (0.137) | (0.137) | (0.138) |
| $FinDep_i \times Default_{ct-1}$ | -0.395** | -0.384** | -0.384** |
| | (0.156) | (0.156) | (0.156) |
| $FinDep_i \times Default_{ct-2}$ | -0.150 | -0.139 | -0.144 |
| | (0.147) | (0.147) | (0.147) |
| $FinDep_i \times Bank_{ct}$ | 0.038 | | 0.049 |
| | (0.116) | | (0.116) |
| $FinDep_i \times Bank_{ct-1}$ | -0.032 | | -0.003 |
| | (0.125) | | (0.127) |
| $FinDep_i \times Bank_{ct-2}$ | 0.048 | | 0.079 |
| | (0.130) | | (0.134) |
| $FinDep_i \times Curr_{ct}$ | | -0.138 | -0.143 |
| | | (0.119) | (0.121) |
| $FinDep_i \times Curr_{ct-1}$ | | -0.101 | -0.110 |
| | | (0.119) | (0.120) |
| $FinDep_i \times Curr_{ct-2}$ | | -0.089 | -0.095 |
| | | (0.114) | (0.114) |
| Controls: | Country-Year, Industry-Year and Group-Industry F.E., $FinDep_i * \ln DC_{ct}$, | | |
| Observations | 51,729 | 51,729 | 51,729 |
| Adj. $R^2$ | 0.86 | 0.86 | 0.86 |

The dependent variable is the log of exports to the world by 3-digit ISIC industries, 1980-2007. All regressions include country-year, industry-year and country group-industry fixed effects, and control for the impact of domestic credit conditions on financially dependent sectors. Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Baseline Regression Results, Controlling for Financial Crises

debt crises, it is insufficient evidence to establish a causal link from default to declines in exports.

To address these concerns, and to test a specific causal mechanism by which a debt crisis may affect the defaulting economies' exports, I estimate equation (11) in Column 4 using country-time and industry-time fixed effects. I also group countries by income and include group-specific industry dummies to allow for differences in specialisation between high- and low-income countries.[10]

[10]Income groups are based on the World Bank's classification of countries into low income, lower-middle income, upper-middle income, non-OECD high-income and OECD high income.

The estimated coefficients of the interaction between default and sectoral financial dependence are negative, large and jointly significant at the 1% level. This confirms the hypothesis developed in the previous sections and represents the main finding of the paper: there is robust evidence that sovereign default reduces the exports of highly financially dependent sectors relative to those which are less financially vulnerable, consistent with a contraction in the supply of credit to exporters. In terms of magnitudes, the coefficient estimates imply that default should cause the exports in the "Textiles" industry − which is at the 75th percentile of industries ranked by their financial dependence − to contract 11 percentage points more (or the expand 11 percentage points less) than "Other non-metallic mineral products" − which is at the 25th percentile.

My regression also finds that higher volumes of domestic credit are associated with a relative contraction of the exports of financially dependent

| Dep. Variable: $\ln Exp_{cit}$ | (1) | (2) | (3) |
|---|---|---|---|
| $FinDep_i \times Default_{ct+1}$ | -0.026 | | -0.024 |
| | (0.153) | | (0.154) |
| $FinDep_i \times Default_{ct}$ | -0.446*** | -0.430*** | -0.431*** |
| | (0.138) | (0.139) | (0.139) |
| $FinDep_i \times Default_{ct-1}$ | -0.383** | -0.367** | -0.366** |
| | (0.157) | (0.158) | (0.159) |
| $FinDep_i \times Default_{ct-2}$ | -0.141 | -0.142 | -0.139 |
| | (0.148) | (0.148) | (0.149) |
| $FinDep_i \times Default_{ct-3}$ | | -0.197 | -0.197 |
| | | (0.143) | (0.143) |
| $FinDep_i \times Default_{ct-4}$ | | -0.195 | -0.195 |
| | | (0.156) | (0.156) |
| Controls: | Country-Year, Industry-Year and Group-Industry F.E., $FinDep_i \times Bank_{ct}$, $FinDep_i \times Bank_{ct-1}$, $FinDep_i \times Bank_{ct-2}$, $FinDep_i \times Curr_{ct}$, $FinDep_i \times Curr_{ct-1}$, $FinDep_i \times Curr_{ct-2}$, $FinDep_i * \ln DC_{ct}$ | | |
| Observations | 51,729 | 51,729 | 51,729 |
| Adj. $R^2$ | 0.86 | 0.86 | 0.86 |

The dependent variable is the log of exports to the world by 3-digit ISIC industries, 1980-2007. All regressions include country-year, industry-year and country group-industry fixed effects, and control for the impact of domestic credit conditions, banking crises and currency crises on financially dependent sectors. Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Additional Lead and Lags of Default

industries but the effect is not robust and small, with a 1% increase in domestic credit causing "Textiles" to contract by a mere .01 percentage points less than "Other non-metallic mineral products". This provides an intriguing contrast with Rajan and Zingales (1998). Their paper shows that deep domestic financial markets benefit the overall growth of industries which are very financially dependent. Yet my findings indicate that domestic financial development, represented by the domestic supply of credit, has only a minor impact on the exports of financially dependent sectors. This lends support to the view that domestic exporters are more reliant on international than on domestic capital markets, and is in line with the findings of Manova (2008) who shows that improved access to foreign credit strongly benefits financially dependent exporters.

A possible objection to the specification in Column 4 of Table 2 is that default may coincide with domestic bank or currency crises, and that the coefficients of interest may capture the impact of these financial crises, rather than a default-specific effect. Banking and currency crises are considerably more frequent in my sample than sovereign debt crises, with a total of 71 episodes of banking sector distress and 90 currency crises covered.[11] Yet only 10 out of 61 sample defaults coincide with a banking or currency crisis in the same year. This makes it implausible *a priori* that my key coefficients capture the omitted effect of the latter episodes.

In Table 3, I control for the effect of banking and currency distress directly. The size and statistical significance of the coefficients of interest is virtually unchanged. Meanwhile, currency crises appear to have a similar effect on sectoral exports as sovereign default, albeit smaller and not statistically significant. By contrast, there is little evidence that banking crises impact on domestic exports through a financial-dependence channel, which underscores the potential importance of foreign credit relative to domestic financial conditions for exporters in crisis-prone economies.

This section has documented that, for the period 1980-2007, the empirical specification derived in Sections 2 lends strong support to the hypothesis default hurt domestic exporters via a reduction in the supply of credit. Below, I explore the robustness of this finding. Unless otherwise indicated, each subsequent regression uses country-year, industry-year and country group-industry fixed effects and controls for the impact of banking and currency crises as well as domestic credit conditions.

[11]The dates of banking and currency crises are based on Laeven and Valencia (2008) and reported in Table A2 of the Appendix.

### 3.2.2 Robustness Checks

So far, I have arbitrarily estimated a model with two lags of the default dummy, implying that the average effect of default on sectoral exports persists for a total of three years. In principle, however, there is no reason why the effect should not be more persistent. Table 4 presents the estimation results when two additional lags (as well as a lead) of the default dummy is included in the estimation.

| Dep. Variable: $\ln Exp_{cit}$ | (1) $t \geq 1994$ | (2) Excluding serial defaulters | (3) Excluding 2 most and least financially dependent industries |
|---|---|---|---|
| $FinDep_i \times Default_{ct}$ | -0.454* | -0.502** | -0.456* |
| | (0.235) | (0.251) | (0.265) |
| $FinDep_i \times Default_{ct-1}$ | -0.420 | -0.182 | -0.253 |
| | (0.270) | (0.265) | (0.302) |
| $FinDep_i \times Default_{ct-2}$ | -0.258 | -0.094 | -0.045 |
| | (0.231) | (0.286) | (0.314) |
| $FinDep_i \times Bank_{ct}$ | -0.043 | 0.106 | 0.392 |
| | (0.173) | (0.131) | (0.304) |
| $FinDep_i \times Bank_{ct-1}$ | -0.094 | 0.011 | 0.058 |
| | (0.174) | (0.145) | (0.303) |
| $FinDep_i \times Bank_{ct-2}$ | -0.048 | 0.056 | 0.297 |
| | (0.172) | (0.154) | (0.324) |
| $FinDep_i \times Curr_{ct}$ | 0.127 | 0.015 | 0.120 |
| | (0.179) | (0.150) | (0.294) |
| $FinDep_i \times Curr_{ct-1}$ | 0.166 | 0.001 | -0.026 |
| | (0.157) | (0.138) | (0.274) |
| $FinDep_i \times Curr_{ct-2}$ | 0.171 | 0.006 | 0.209 |
| | (0.134) | (0.133) | (0.268) |
| $FinDep_i * \ln DC_{ct}$ | -0.029** | -0.036*** | 0.134*** |
| | (0.013) | (0.011) | (0.024) |
| Controls: | Country-Year, Industry-Year and Group-Industry F.E. | | |
| Observations | 30,152 | 42,411 | 40,357 |
| Adj. $R^2$ | 0.87 | 0.88 | 0.87 |

The dependent variable is the log of exports to the world by 3-digit ISIC industries, 1980-2007. All regressions include country-year, industry-year and country group-industry fixed effects, and control for the impact of domestic credit conditions, banking crises and currency crises on financially dependent sectors. Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Sample Restrictions

Column 1 shows that the coefficient on the lead of default is small and not statistically significant at any reasonable level. This is reassuring as it indicates that there is no robust change in sectoral export patterns prior to the default event, supporting the hypothesis of a causal relationship proposed here. Two additional lags of default return negative but statistically insignificant coefficients, irrespective of whether the lead is included or not (Columns 2 and 3). Throughout, the baseline coefficients and standard errors remain unaltered. This evidence seems to imply that the change in sectoral export patterns commences in the year of default and fades over time.

| Dep. Variable: $\ln Exp_{cit}$ | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $FinDep_i \times Default_{ct}$ | -0.445*** | | -0.446*** | | -0.432*** |
| | (0.138) | | (0.139) | | (0.135) |
| $FinDep_i \times Default_{ct-1}$ | -0.384** | | -0.411*** | | -0.430*** |
| | (0.156) | | (0.148) | | (0.151) |
| $FinDep_i \times Default_{ct-2}$ | -0.144 | | -0.181 | | -0.188 |
| | (0.147) | | (0.141) | | (0.138) |
| $Tang_i \times Default_{ct}$ | | 0.160 | 0.158 | | |
| | | (0.474) | (0.473) | | |
| $Tang_i \times Default_{ct-1}$ | | 0.557 | 0.635 | | |
| | | (0.423) | (0.410) | | |
| $Tang_i \times Default_{ct-2}$ | | 0.412 | 0.473 | | |
| | | (0.390) | (0.382) | | |
| $ImPen_{ci} \times Default_{ct}$ | | | | -0.793 | -0.424 |
| | | | | (0.784) | (0.769) |
| $ImPen_{ci} \times Default_{ct-1}$ | | | | 0.783 | 1.268 |
| | | | | (0.820) | (0.786) |
| $ImPen_{ci} \times Default_{ct-2}$ | | | | 0.783 | 1.000 |
| | | | | (0.865) | (0.823) |
| $ImPen_{ci}$ | | | | -0.430* | -0.451* |
| | | | | (0.248) | (0.248) |
| Controls: | Country-Year, Industry-Year and Group-Industry F.E., $FinDep_i \times Bank_{ct}$, $FinDep_i \times Bank_{ct-1}$, $FinDep_i \times Bank_{ct-2}$, $FinDep_i \times Curr_{ct}$, $FinDep_i \times Curr_{ct-1}$, $FinDep_i \times Curr_{ct-2}$, $FinDep_i$* $\ln DC_{ct}$ | | | | |
| Observations | 51,729 | 51,729 | 51,729 | 51,690 | 51,690 |
| Adj. $R^2$ | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |

The dependent variable is the log of exports to the world by 3-digit ISIC industries, 1980-2007. All regressions include country-year, industry-year and country group-industry fixed effects, and control for the impact of domestic credit conditions, banking crises and currency crises on financially dependent sectors. Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Alternative Industry Characteristics

With no more than two relevant lags of default, my model seems to find a less persistent impact of default on trading patterns than previous studies. Rose's (2005) baseline specification contains 15 lags of default, and Martinez and Sandleris (2008) choose 5 lags in their most preferred specification. Both admit, however, that problems of multicolinearity make the appropriate lag structure difficult to determine.[12] Moreover, a three-year duration of the effect of default on sectoral export patterns would be broadly consistent with the observation by Gelos et al. (2003) that the average period of capital-market exclusion suffered by defaulters between 1980 and 1999 was 4.5 years. This would in turn support the notion that capital-market access is crucial in explaining the link between sovereign default and trading patterns.

Table 5 explores the effect of several sample restrictions. The estimated impact of sovereign default on sectoral export patterns is, if anything, stronger if the estimation is restricted to the second half of the sample period (Column 1), and the three coefficients of interest remain jointly significant at the 1% level. A similar picture emerges if countries which defaulted more than once between 1980 and 2007 are excluded (Column 2). Excluding the three most financially dependent industries – "Plastic products", "Professional and scientific equipment" and "Electric machinery" – and the three least financially dependent industries – "Tobacco", "Pottery" and "Leather products" – delivers coefficient estimates which are similar in magnitude to the baseline, but with larger standard errors.

In Table 6, I allow for default to affect sectoral exports in accordance with two other industry characteristics, the industry's asset tangibility and its import penetration. Asset tangibility of industry $i$ is defined as the share of net plant, property, and equipment in total assets for the median U.S. firm in $i$. This measure is used in the literature to capture an industry's ability to muster collateral and its source is Braun (2003), who shows it to be uncorrelated with the Rajan-Zingales measure of financial dependence. Import penetration is a country-industry-specific indicator based on a sector's average share in total imports. It is defined as $ImpPen_{ct} = \frac{1}{T}\sum_t (Imp_{cit}/\sum_i Imp_{cit})$, where $Imp_{cit}$ is the nominal value of imports by country $c$ in industry $i$ and year $t$.

Columns 1 to 5 of Table 6 show that the additional interactions do not alter the baseline result. There is evidence of a shift in exports towards sectors with

[12]Note that Rose (2005) and Martinez and Sandleris (2008) use renegotiations of publicly held debt through the Paris Club to construct their default dummy, while I use records of defaults on private bank and bond debt. The Paris Club data is useful to the particular question these studies attempt to address, but Paris Club renegotiations are more frequent than the repudiation of privately held debt – giving rise to multicolinearity problems in lagged models – and arguably less representative of the non-cooperative nature of default commonly alleged in the theoretical literature.

| Dep. Variable: $\ln Exp_{cit}$ | (1) | (2) | (3) |
|---|---|---|---|
| $FinDep_i \times Default_{ct}$ (*CA reversal*) | -0.451*** (0.163) | | -0.458*** (0.163) |
| $FinDep_i \times Default_{ct-1}$ (*CA reversal*) | -0.399** (0.183) | | -0.407** (0.183) |
| $FinDep_i \times Default_{ct-2}$ (*CA reversal*) | -0.255* (0.154) | | -0.251 (0.155) |
| $FinDep_i \times Default_{ct}$ (*no CA reversal*) | | -0.398 (0.244) | -0.418* (0.250) |
| $FinDep_i \times Default_{ct-1}$ (*no CA reversal*) | | -0.275 (0.283) | -0.313 (0.286) |
| $FinDep_i \times Default_{ct-2}$ (*no CA reversal*) | | 0.207 (0.336) | 0.176 (0.337) |
| Controls: | Country-Year, Industry-Year and Group-Industry F.E., $FinDep_i \times Bank_{ct}$, $FinDep_i \times Bank_{ct-1}$, $FinDep_i \times Bank_{ct-2}$, $FinDep_i \times Curr_{ct}$, $FinDep_i \times Curr_{ct-1}$, $FinDep_i \times Curr_{ct-2}$, $FinDep_i * \ln DC_{ct}$ | | |
| Observations | 51,729 | 51,729 | 51,729 |
| Adj. $R^2$ | 0.86 | 0.86 | 0.86 |

The dependent variable is the log of exports to the world by 3-digit ISIC industries, 1980-2007. All regressions include country-year, industry-year and country group-industry fixed effects, and control for the impact of domestic credit conditions, banking crises and currency crises on financially dependent sectors. Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Current Account Reversals

a large share of collateralisable assets in the years following default, but none of the coefficients on the relevant interaction terms are statistically significant. By contrast, there is no clear indication that the degree of a sector's importer penetration affects its response to a sovereign debt crisis in either direction.

Finally, I assess whether the differential impact of sovereign default across sectors coincides with a change in the defaulting country's pattern of foreign borrowing. If default is associated with a loss of access to foreign credit markets which hurts financially dependent exporters, the latter effect should be stronger the larger the reversal in foreign borrowing. Section 3.1.2 observes that most defaulters were net recipients of foreign capital flows in the two years prior to default. Comparing countries' average current account balance in the two years before and after default episodes, I find that two thirds of these episodes were associated with an improvement in the current account (i.e. a decline in net foreign borrowing). I group default episodes into two categories,

depending on whether they coincided with a current account reversal or not. I then construct separate default dummies for each category.

Table 7 presents the results of my estimations when default is grouped according to whether or not a current account reversal took place. The table documents that both categories are associated with a decline in the exports of financially dependent sectors relative to less financially vulnerable counterparts, but the effect is only statistically significant − and considerably stronger − for default episodes associated with current account reversals. Of course, this finding does not imply a causal link between default and current account reversals, but it provides further evidence that access to international capital markets plays a crucial role for explaining changes in the patterns of trade in the wake of sovereign debt crises.

## 3.3 Financial Dependence and the Decline in Exports

### 3.3.1 Magnitude of the Financial-Dependence Channel

Following on from equation (10), the impact of sovereign default at $t$ on exports in sector $i$ is

$$\left.\frac{\triangle Exp_{cit}}{Exp_{cit}}\right|_{\triangle Default_{ct}=1} = \beta_1 FinDep_i + \beta_2, \tag{12}$$

where I drop the lag-related subscripts for expositional convenience. Equation (12) implies

$$\left.\frac{\triangle Exp_{ct}}{Exp_{ct}}\right|_{\triangle Default_{ct}=1} = \beta_1 \frac{\sum_i FinDep_i Exp_{cit}}{\sum_i Exp_{cit}} + \beta_2, \tag{13}$$

where $\sum_i FinDep_i Exp_{cit} / \sum_i Exp_{cit}$ is the average financial dependence of exports in country $c$ and year $t$. Equation (13) describes the overall impact of sovereign default on a country's manufacturing exports, which consists of the financial-dependence-related impact ($\beta_1$) and a possible direct effect ($\beta_2$). My estimates from Section 3.2 only allow me to identify the importance of the financial-dependence channel, which is conditional on a country's export composition at the time of default. Figure 2 plots the the impact from this channel for the 61 default episodes in my sample.[13]

The figure documents that, by itself, the financial-dependence channel emphasised in this paper implied a reduction in countries' overall exports following almost all of the 61 defaults. The median and mean of the distribution are

[13] One way to think about Figure 2 is as a plot of the distribution of (13) for the 61 debt crises assuming $\beta_2 = 0$. To construct the figure, I use the average financial dependence of exports for each defaulter in the three years prior to the debt crisis, and let $\hat{\beta}_1 = \frac{1}{3}\left(\hat{\beta}_{10} + \hat{\beta}_{11} + \hat{\beta}_{12}\right) \approx -.324$ from my baseline regression.

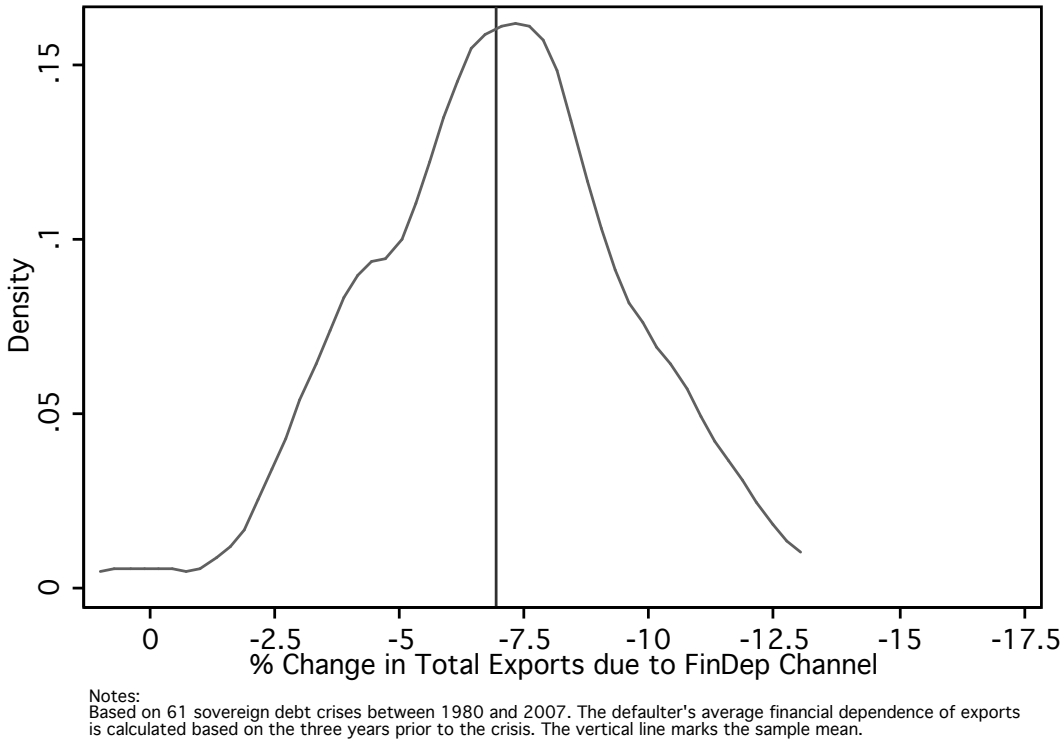



Figure 2: Distribution of $\beta_1 \times \sum_i FinDep_i Exp_{cit} / \sum_i Exp_{cit}$ for Sample Defaults

very close, at -7.0% and -6.9% respectively. This number is clearly economically significant. Nevertheless, it would be desirable to ascertain for how much of the *overall* change in manufacturing exports in the wake of the average default this channel can account. To answer this question, the next section considers alternative estimates of the overall impact of default on exports.

### 3.3.2 Overall Impact of Default on Exports

As discussed in Section 3.1.1, the overall impact of default on sectoral exports is difficult to estimate consistently. Column 1 of Table 8 provides the results from a panel regression, using my full sample and year and country-industry fixed effects, where the effect of crises − and specifically, default − is captured by dummies taking value 1 in the first year of the episode and the two subsequent years. This is akin to the regression estimated in Column 3 of Table 2. If equation (12) describes the true effect of default on sectoral exports, the estimated coefficient in Table 8 captures *both* the direct effect of default ($\beta_2$) *and* the financial-dependence-related impact ($\beta_1$) conditional on the average defaulter's export composition. The estimate suggests that the combined effect amounts to an average decline in exports of 11% for three years.

Arguably, the results reported in Column 1 of Table 8 may overstate the overall impact of default on exports because the regression misses crucial

| Dep. Variable: $\ln Exp_{cit}$ | (1) Full Panel | (2) PSM Diff.-in-Diff. |
|---|---|---|
| $Post_t$ | | 0.452*** |
| | | (0.063) |
| $Default_{ct}$ | -0.109*** | -0.155* |
| | (0.041) | (0.094) |
| $Bank_{ct}$ | -0.034 | -0.198** |
| | (0.023) | (0.097) |
| $Curr_{ct}$ | 0.008 | -0.165* |
| | (0.023) | (0.085) |
| $\ln GDP_{ct}$ | 0.073 | 0.009 |
| | (0.064) | (0.276) |
| $\ln DC_{ct}$ | 0.098*** | -0.066 |
| | (0.033) | (0.130) |
| Year F.E. | Yes | No |
| Country-Indust. F.E. | Yes | Yes |
| Observations | 51,729 | 2,844 |
| Adj. $R^2$ | 0.93 | 0.92 |

The dependent variable in regression (1) is the log of exports to the world by 3-digit ISIC industries, 1980-2007. The crisis dummies in regression (1) take value 1 in the first three years after a default, bank or currency crisis. The dependent variable in regression (2) is the log of average industry exports in the three years before and after a default episode. Both regressions include country-industry fixed effects, and control for GDP and domestic credit conditions. Standard errors are clustered at the country-year level.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Overall Impact of Default on Exports

country-time varying explanatory variables, or because the true causality may be reversed with default triggered by the incipient decline in exports. To tackle this issue, I derive an alternative estimate of the overall impact of default on sectoral exports using a propensity score matching (PSM) approach.[14] This approach is also used in Levchenko, Rancière and Thoenig (2009) to identify the impact of financial liberalisation on sectoral output growth. Its basic premise is the identification of an appropriate control group to estimate a classic difference-in-difference model: for each country $c$ experiencing default in year $t$, a control country is identified which displayed a similar propensity to default at $t$ but did not experience default. If the match between treatment

[14]The use of instruments in the present context faces the insurmountable challenge of identifying a variable which is highly correlated with a country's propensity to default on foreign debt, but uncorrelated with the volume of its exports.

and control countries is appropriate, the PSM methodology simulates a random experiment.[15]

To determine a country's propensity to default in year $t$, I estimate a logistic regression of the form

$$Default_{ct} = \alpha_0 + \alpha_1 DefaultExpectation_{ct} + \alpha_2 \triangle \ln GDP_{ct} + \varepsilon_{ct}, \qquad (14)$$

where $Default_{ct}$ takes value 1 if default occurred in $c$ at $t$ and 0 otherwise, $DefaultExpectation_{ct}$ is a measure of a country's perceived default probability, and $\triangle \ln GDP_{ct}$ captures contemporaneous deteriorations in economic conditions. $DefaultExpectation_{ct}$ is measured using historical "foreign debt risk" scores from the Political Risk Services Group, while $\triangle \ln GDP_{ct}$ is based on GDP data from the World Development Indicators.[16] The specification is designed to match countries based on expectations of debt distress ahead of the default date as well as short-term economic changes likely to trigger default. It passes the Dehejia and Wahba (2002) test of equality of means within strata − a key criterion for the PSM approach to be applicable in this context.

Using the propensity scores predicted by the logit model, I calculate the proximity between countries $c$ and $d$ based on their default propensity as

$$Proximity_{cd} = \frac{1}{3} \sum_{t=t_c-2}^{t_c} \left(ps_{ct} - ps_{dt}\right)^2,$$

where $t_c$ is the year in which $c$ defaulted and $ps_{ct}$ is $c$'s propensity score at $t$. I use the first neighbour matching method and define the appropriate control country for defaulter $c$ as

$$CC_c = \arg \min_{d \in C, |t_c - t_d| \geq 3} Proximity_{cd},$$

where the restriction $|t_c - t_d| \geq 3$ is imposed to prevent countries which defaulted at nearby dates from being chosen as control. Table A3 in the Appendix lists the control countries for each default episode.

Having chosen control countries, I estimate the following difference-in-difference specification:

$$\ln Exp_{cit} = \theta_0 Post_t + \theta_1 Default_{ct} + \delta_{ci} + \gamma Z_{cit} + \varepsilon_{cit},$$

[15] My PSM approach in this section closely follows Levchenko, Rancière ad Thoenig (2009). The interested reader is referred to their paper for a more detailed discussion of the PSM methodology.

[16] As the "foreign debt risk" scores have only been calculated since 1985, I am forced to restrict my PSM analysis to default episodes which occurred after this date.

where $\ln Exp_{cit}$ represents the log of countries' average exports in the three years before and after the default episode, $Post_t$ is a dummy taking value 0 before the episode and 1 after, and $Default_{ct}$ is a binary indicator taking value 1 if a country experienced a debt crisis. As before $Z_{cit}$ is a vector of control variables and $\delta_{ci}$ a set of country-industry fixed effects. The results from the OLS regression are reported in Column 2 of Table 8.

The PSM regression finds a 16% average decline in manufacturing sector exports as a result of sovereign default − somewhat larger than the magnitude of the decline estimated in the panel regression. The coefficient estimate is significant at the 10% level of statistical significance. It indicates that, if anything, the panel regression may understate the overall reduction in exports due to default.

Table 9 compares these findings with the impact of sovereign default on trade flows estimated in earlier studies. Rose (2005) and Martinez and Sandleris (2008) identify the impact of default on international trading patterns by analysing bilateral trade flows in the aftermath of sovereign debt renegotiations. The table displays results from their most comparable reported specifications, using a default dummy with four lags. It highlights that my estimates are in the same ball park as theirs, despite methodological differences, with the estimated overall decline in exports due to default ranging from 6 to 16%. This implies that, if we accept the "true" overall decline in exports

| Source: | (1) Table 8 | (2) Table 8 | (3) Martinez and Sandleris ('08) | (4) Rose ('05) |
|---|---|---|---|---|
| $\frac{\Delta Exp_{ct}}{Exp_{ct}}$ *due to default* | -0.11 | -0.16 | -0.06 | -0.11 |
| Persistence | 3 years | 3 years | 5 years | 5 years |
| Identification | Annual panel of sector-level exports, with country-industry and year F.E. | Diff.-in-diff. on sector-level exports, with control countries based on propensity score. | Annual panel of bilateral trade flows, with country and year fixed effects. Default dummy captures the impact on trade will all partners. | Annual panel of bilateral trade flows, with country and year fixed effects. Default dummy captures the impact on trade with defaulted creditors. |

Columns (3) and (4) report comparable regression results from the two respective papers. Persistence indicates the number of years default is assumed to affect trade flows in the given empirical specification, including the year in which default took place.

Table 9: Overall Impact of Default on Exports, Comparison

caused by sovereign default to lie in this range, the financial-dependence channel uncovered in this paper can explain at least half of the impact of sovereign default on trade. The "trade costs" of sovereign default identified by Rose (2005) may thus be a mere symptom of capital-market exclusion triggered by sovereign debt distress.

# 4 Summary and Conclusion

In this paper I demonstrate empirically that sovereign default leads to a decline of the defaulting country's exports in sectors with a high degree of financial dependence relative to sectors which are less financially vulnerable. I argue that this is due to a reduction in domestic exporters' access to foreign capital. Although the evidence for this claim is indirect, it is also compelling. The estimated impact of default on sectoral exports occurs independently of the depth of domestic credit markets or contemporaneous systemic crises among resident banks. It is robust to changes in the sample composition, and to controlling for a possible impact of default on sectoral exports through alternative channels. It is also more pronounced for defaulters which experienced large current account reversals.

My findings suggest that there exists a link between the sovereign's ability to tap international capital markets in the aftermath of default and the observed effect of sovereign debt crises on trade, widely interpreted as "trade costs" of debt repudiation. Early proponents of such "trade costs" seem to have been sympathetic to the view that these were credit-related. Bulow and Rogoff (1989), for example, contend that if a country repudiates its foreign loans it will "also be blocked from normal access to trade credits". So far, however, the present paper constitutes the only formal, broad-based empirical investigation to provide evidence of a credit link between default and the patterns of international trade. According to my estimates, this link can explain most of the decline in trade triggered by sovereign debt crises.

From a theoretical vantage point, the observation that the "trade costs" of default may constitute part of the overall costs of capital-market exclusion has profound implications for our understanding of the factors which induce governments to service their foreign debt. Much of the recent literature on sovereign borrowing treats the threat of capital-market exclusion and the risk of "trade costs" as substitutable explanations for why countries choose to honour their obligations to foreign creditors. Based on the empirical analysis carried out in this paper, this notion is is mistaken: if default does not reduce the defaulting country's access to international lending, the "trade costs" of default

may also fail to materialise. This implies that whenever circumstances render capital-market exclusion unlikely − due to, say, coordination problems among lenders −, we are bereft of an an alternative explanation of how sovereign default might be deterred.

The question why countries repay their foreign debt is alive and well.

# Appendix

| Country | Debt Crisis | First Year of Bank Crisis | Currency Crisis |
|---|---|---|---|
| Albania | 1991 | 1994 | 1997 |
| Argentina | 1982, 1989, 2001 | 1980, 1989, 1995, 2001 | 1981, 1987, 2002 |
| Australia | | | |
| Austria | | | |
| Azerbaijan | | 1995 | 1994 |
| Bangladesh | | 1987 | |
| Barbados | | | |
| Belarus | | 1995 | 1994, 1999 |
| Belize | 2006 | | |
| Bolivia | 1980, 1986, 1989 | 1986, 1994 | 1981 |
| Brazil | 1983 | 1990, 1994 | 1987, 1992, 1999 |
| Cameroon | | 1987, 1995 | |
| Chad | | 1992 | 1994 |
| Chile | 1983 | | |
| China | | 1998 | |
| Colombia | | 1982, 1998 | 1985 |
| Congo, Dem. Rep. | | 1983, 1991, 1994 | 1983, 1989, 1994, 1999 |
| Congo, Rep. | 1983 | 1992 | 1994 |
| Costa Rica | | 1987, 1994 | 1991 |
| Côte d'Ivoire | 1983, 2000 | | |
| Croatia | 1992 | 1998 | |
| Czech Republic | | 1996 | |
| Denmark | | | |
| Djibouti | | 1991 | |
| Dominica | 2003 | | |
| Dominican Republic | 1982, 2005 | 2003 | 1985, 1990, 2003 |
| Egypt, Arab Rep. | 1984 | | 1990 |
| El Salvador | | 1989 | 1986 |
| Fiji | | | |
| Finland | | 1991 | 1993 |
| France | | | |
| Gabon | 1999, 2002 | | 1994 |
| Georgia | | | 1992, 1999 |
| Germany | | | |
| Ghana | 1987 | 1982 | 1983, 1993, 2000 |
| Greece | | | 1983 |
| Grenada | 2004 | | |
| Guatemala | 1989 | | |
| Guinea | 1986, 1991 | 1993 | 2005 |
| Haiti | | 1994 | 1992, 2003 |
| Honduras | | | 2003 |
| Hong Kong, China | | | |
| Hungary | | 1991 | |
| Iceland | | | 1981, 1989 |
| India | | 1993 | |
| Indonesia | 1998, 2000, 2002 | 1997 | 1998 |
| Ireland | | | |
| Israel | | | 1985 |
| Italy | | | 1981 |
| Jamaica | 1981, 1987 | 1996 | 1983, 1991 |
| Japan | | 1997 | |
| Jordan | 1989 | 1989 | 1989 |
| Kenya | 1994 | 1985, 1992 | 1993 |
| Korea, Rep. | | 1997 | 1998 |
| Lebanon | | 1990 | 1990 |
| Madagascar | 1981, 1986 | | 1994, 2004 |
| Malawi | 1988 | | 1994 |
| Malaysia | | 1997 | 1998 |
| Mali | | 1987 | |
| Mauritania | 1992 | 1984 | 1993 |
| Mauritius | | | |
| Mexico | | 1994 | 1995 |
| Mongolia | | | 1990, 1997 |
| Morocco | 1983, 1986 | 1980 | 1981 |
| Mozambique | 1983 | 1987 | 1987 |
| Nepal | | 1988 | 1984, 1992 |
| Netherlands | | | |
| New Zealand | | | |
| Nicaragua | 2003 | 1990, 2000 | 1990 |
| Pakistan | 1999 | | |
| Panama | 1987 | 1988 | |
| Papua New Guinea | | | |
| Paraguay | 2003 | 1995 | 2002 |
| Peru | 1980, 1983 | 1983 | 1981, 1988 |
| Philippines | 1983 | 1983, 1997 | 1993, 1998 |
| Poland | | | |
| Portugal | | | 1983 |
| Romania | | 1990 | 1996 |
| Rwanda | | | 1991 |
| Senegal | 1981, 1990, 1992 | | 1994 |
| Sierra Leone | 1983, 1986 | 1990 | 1983, 1989, 1998 |
| Singapore | | | |
| South Africa | 1985, 1993 | | 1984 |
| Spain | | | 1983 |
| Sri Lanka | | 1989 | |
| Suriname | | | 1990, 1995, 2001 |
| Sweden | | 1991 | 1993 |
| Switzerland | | | |
| Syrian Arab Republic | | | |
| Thailand | | 1983, 1997 | 1998 |
| Togo | 1988, 1991 | | 1994 |
| Trinidad and Tobago | 1988 | | 1986 |
| Tunisia | | 1991 | |
| Turkey | | 2000 | 1991, 1996, 2001 |
| United Kingdom | | 2007 | |
| United States | | 1988, 2007 | |
| Uruguay | 1983, 1987, 1990, 2003 | 2002 | 1983, 1990, 2002 |
| Vietnam | | 1997 | |
| Zimbabwe | | 1995 | 1991 |

Table A1: Sample Countries and Financial Crises

| ISIC | Industry Description | $FinDep_i$ | $Tang_i$ |
|---|---|---|---|
| 311 | Food products | .1368 | .3777 |
| 313 | Beverages | .0722 | .2974 |
| 314 | Tobacco | -.4512 | .2208 |
| 321 | Textiles | .4005 | .3730 |
| 322 | Wearing apparel, except footwear | .0286 | .1317 |
| 323 | Leather products | -.1400 | .0960 |
| 324 | Footwear, except rubber or plastic | -.0799 | .1167 |
| 331 | Wood products, except furniture | .2840 | .3796 |
| 332 | Furniture, except metal | .2357 | .2630 |
| 341 | Paper and products | .1756 | .5579 |
| 342 | Printing and publishing | .2038 | .3007 |
| 351 | Industrial chemicals | .2050 | .4116 |
| 352 | Other chemicals | .2178 | .1973 |
| 353 | Petroleum refineries | .0420 | .6708 |
| 354 | Miscellaneous petroleum and coal products | .3341 | .3038 |
| 355 | Rubber products | .2265 | .3790 |
| 356 | Plastic products | 1.1401 | .3448 |
| 361 | Pottery, china | -.1459 | .0745 |
| 362 | Glass and products | .5285 | .3313 |
| 369 | Other non-metallic mineral products | .0620 | .4200 |
| 371 | Iron and steel | .0871 | .4581 |
| 372 | Non-ferrous metals | .0055 | .3832 |
| 381 | Fabricated metal products | .2371 | .2812 |
| 382 | Machinery, except electrical | .4453 | .1825 |
| 383 | Machinery, electric | .7675 | .2133 |
| 384 | Transport equipment | .3069 | .2548 |
| 385 | Professional and scientific equipment | .9610 | .1511 |
| 390 | Other manufactured products | .4702 | .1882 |

Table A2: Sample Industries and Industry Characteristics

| Default Episode | | Control Country |
|---|---|---|
| Albania | 1991 | Romania |
| Argentina | 1989 | Kenya |
| Argentina | 2001 | Philippines |
| Bolivia | 1986 | Peru |
| Bolivia | 1989 | El Salvador |
| Côte d'Ivoire | 2000 | Sierra Leone |
| Gabon | 1999 | Sri Lanka |
| Gabon | 2002 | Philippines |
| Ghana | 1987 | Guinea |
| Guatemala | 1989 | El Salvador |
| Guinea | 1991 | Hungary |
| Indonesia | 1998 | Syrian Arab Republic |
| Indonesia | 2000 | Syrian Arab Republic |
| Indonesia | 2002 | Turkey |
| Jamaica | 1987 | Paraguay |
| Jordan | 1989 | Kenya |
| Kenya | 1994 | Syrian Arab Republic |
| Madagascar | 1986 | Chile |
| Malawi | 1988 | Mali |
| Morocco | 1986 | Israel |
| Nicaragua | 2003 | Congo, Dem. Rep. |
| Pakistan | 1999 | Senegal |
| Panama | 1987 | Costa Rica |
| Paraguay | 2003 | Egypt, Arab Rep. |
| Senegal | 1990 | Greece |
| Senegal | 1992 | Greece |
| Sierra Leone | 1986 | Peru |
| South Africa | 1993 | Philippines |
| Togo | 1988 | Kenya |
| Togo | 1991 | Hungary |
| Trinidad and Tobago | 1998 | Mali |
| Uruguay | 1987 | Mongolia |
| Uruguay | 1990 | Mexico |
| Uruguay | 2003 | Zimbabwe |

Table A3: Default Episodes and PS-Matched Control Countries

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